

# Incorporating basic needs to reconcile poverty and ecosystem services

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## Impact Statement

Assessing human needs and their connections with ecosystem services helps balance poverty alleviation and biodiversity protection.

## Abstract.

Conservation managers frequently face the challenge of protecting and sustaining biodiversity without producing detrimental outcomes for (often poor) human populations that depend upon ecosystem services for their wellbeing. However, win-win solutions are often elusive and can mask trade-offs and negative outcomes for the wellbeing of particular groups of people. To deal with such trade-offs, approaches are needed to identify both ecological as well as social thresholds to determine the acceptable 'solution space' for conservation. Although human wellbeing as a concept has recently gained prominence among conservationists, they still lack tools to evaluate how their

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action affects human wellbeing in a given context. This paper presents the Theory of Human Needs in the context of conservation, building on an extensive historical application of needs approaches in international development. We detail an innovative participatory method, to evaluate how human needs are met, using locally relevant thresholds. We then establish the connections between human needs and ecosystem services. An application of this method in coastal East Africa identifies households who are in serious harm through not meeting different basic needs, and uncovers the role of ecosystem services in meeting these. Drawing from the international development and wellbeing literature, we suggest that this methodological approach, can help conservationists and planners balance poverty alleviation and biodiversity protection, ensure that conservation measures do not, at the very least, push individuals into serious harm and as a basis for monitoring the impacts of conservation on multidimensional poverty.

## Introduction.

Poverty and biodiversity loss are two of the world's most critical challenges. It is widely accepted that these are linked problems which frequently coincide at various scales (Turner et al. 2012) and that they should be tackled together (Adams et al. 2004). Any vision of sustainable development must recognise that eradicating poverty is inextricably linked to ecological integrity and vice versa (Raworth 2012). As such, it requires that all people have the resources to fulfil their needs but that humanity's use of natural resources does not stress critical Earth system processes. There is therefore a strong imperative for conservation to consider human wellbeing to either gain legitimacy, to improve conservation outcomes or to determine whether interventions are producing positive outcomes for both people and nature (Milner-Gulland et al. 2014). A growing body of research addressing these issues seeks to better understand how ecosystem services – the benefits that humans gain from the environment – could be managed and enhanced in order to further improve wellbeing and alleviate poverty (Fisher et al. 2013). Achieving this involves a difficult balancing act between two competing, and often conflicting, objectives – improving people's lives

through natural resource access and consumption, whilst also ensuring ecological health and sustainability of biodiversity in the face of growing populations and pressures on resources. It has proved a challenge for conservation, and in practice steering the contribution of ecosystem services towards greater poverty alleviation is riddled with difficulty and limited success – with many potential ‘benefits’ failing to reach the poorest people and being captured instead by wealthier and more powerfully positioned ‘elite’ groups (Thompson & Homewood 2002). This means that win-win scenarios, where both conservation and development goals are achieved, are elusive (Chaigneau & Brown 2016) and may mask trade-offs and negative outcomes for the wellbeing of particular people (Daw et al. 2015). These clashing ‘development’ and ‘environmental’ priorities (Roe & Elliott 2004), find common ground in international policies and rhetoric about sustainability. The post 2015 Sustainable Development Goals for example, signals the re-emergence of ‘sustainability’ and ‘development’ as part of an integrated set of global ambitions (Griggs et al. 2013).

This paper directly addresses the challenge identified by Palmer Fry et al. (2017), to incorporate locally-valid measures of wellbeing to assess environmental outcomes, and the call by Milner Gulland et al. (2014) to develop empirical evidence and tools to apply wellbeing concepts that balance local and universal indicators to inform conservation. It builds on work seeking to apply concepts such as wellbeing and poverty when assessing the impacts of conservation (Ferraro & Hanauer 2014), but makes specific advances in the field by applying basic needs measures to identify context-specific social thresholds.

### ***Ecological and Social Thresholds.***

Environmental management is increasingly informed by evidence of non-linear dynamics in ecosystems and the identification of ecological thresholds. These are points at which environmental degradation or pressures lead to disproportionate and sometimes irreversible environmental change with potentially drastic social and economic effects (Kelly et al. 2015). Whilst ecological thresholds are increasingly studied, the concept of social thresholds are underrepresented and we argue that

the threshold concept should not be left to the physical sciences alone. Whilst we acknowledge that ontological difference means that the concept of ‘thresholds’ does not easily translate across the natural and social sciences, a threshold point can nevertheless provide a distinct moment which can encourage innovation and transformations in management practice (Christensen & Krogman 2012). Incorporating the concept of a social threshold would help in understanding points at which impacts become too great to be morally feasible and/or irrevocable (Walker & Meyers 2004). Combining social with ecological thresholds maps out a potential solution space for morally acceptable conservation interventions, which have potential to find consensus across a greater number of affected stakeholders (Fig. 1).

A multidimensional conceptualisation of wellbeing elucidates these social thresholds. It has been proposed as a concept that elucidates the breadth of ways in which ecosystem services can contribute to, or detract from, the quality of people’s lives (Milner-Gulland et al. 2014; Breslow et al. 2016). Conventional understandings of human-environment interactions have been limited by overly narrow interpretations of human welfare, for example, using income or other easily quantified attributes (Coulthard et al 2018). We argue these narrow interpretations exacerbate the difficulty of navigating trade-offs between conservation and development objectives.

There are now many frameworks with varying lists of different criteria which shape how wellbeing might be captured, measured, and ultimately understood (Fisher et al. 2013; Breslow et al. 2016). These have helped shift the development debate away from a narrow focus on objective dimensions of poverty, in particular income poverty, to a broader discussion about wellbeing – about what people need to be able to have, to be able to do and be able to feel in order to be well in society (Gough et al. 2007). As such, different people have different ideas about what is important for their wellbeing and how they should seek to achieve wellbeing. The fact that different groups of individuals may want different things and have competing interests means that optimising for conservation or environmental management may not always appear to be the most advantageous

for some people (Martin 2017). Where resources are scarce, it is most critical to identify, prioritise and address situations in which people are deprived of their basic human needs and to focus conservation and development approaches towards addressing the most important deprivations (McGregor et al. 2009). In such instances, the idea of a justifiable minimum social threshold is useful to ensure that “no one is left behind” in accordance with the 2030 Agenda for sustainable development.

We propose that such thresholds can be supported by the list of universal criteria for assessing human needs from Doyal and Gough’s (1991) theory of human need. The distinctiveness and appeal of this theory over other wellbeing or poverty frameworks for informing environmental management and conservation decisions in the face of trade-offs is twofold: first, it provides a universal list of human needs that apply to all humans on the planet. This is a powerful attribute since it enables a degree of comparability and repeatability, avoiding some of the problems of relativism - although the ways in which needs are met are context specific. In her argument for universal lists of wellbeing criteria, the political philosopher Nussbaum (2001) argues that such lists can represent “a set of basic constitutional principles that should be respected and implemented by the governments of all nations, as a bare minimum of what respect for human dignity requires”. Second, human needs provide life essentials, without which the person would incur serious *harm* of an objective kind (Doyal & Gough 1991). As such, human needs provide a critical minimum threshold of human welfare which all governments and decision makers could morally respect to maintain in their governed populations. It therefore provides a universal list of criteria which conservationists and decisionmakers anywhere can agree to adhere to, driven by the principle of ‘do no harm’ conservation. The theory of human need is one of many approaches in terms of conceptualising poverty and measuring poverty thresholds specifically (Alkire 2002; Tsui 2002), but we argue that its universality and tangibility make it a rich operational framework for addressing hard choices between nature conservation and poverty alleviation goals (Gough 2014; O’Neill et al. 2018) and a basis for monitoring and mitigating conservation impacts on multidimensional poverty.

In this paper we describe a novel process to operationalise the human needs approach that can assess the levels and types of deprivation experienced by people (see also McGregor et al. 2007). We therefore elaborate on how ‘harm’ can be conceived and who is being harmed across different circumstances. We detail the methodological approach used exemplify the process using a case study of eight rural and urban communities in coastal Kenya and Northern Mozambique and explore the contribution of ecosystem services to keeping people out of serious harm. Finally we discuss how this approach could help in evaluating the impact of conservation measures in such a way as to ensure that these are not pushing people into serious harm.

## Method.

### *Study Context and Sites.*

The data were collected as part of a larger project ([www.espa-spaces.org](http://www.espa-spaces.org)) working to establish how marine ecosystem services contributed to human wellbeing and poverty alleviation in coastal communities in Kenya and northern Mozambique.

The study was conducted in four sites in Kenya and four in Mozambique adjacent to mangrove or coral ecosystems in rural and urban areas (more information for each site available at [www.espa-spaces.org](http://www.espa-spaces.org)). Community profiles were developed for each based on secondary sources, participatory observation and key informant interviews. These identified characteristics of each site and the main livelihood activities in particular with relation to their environment. The sites included urban contexts (Kongowea in Mombasa, Kenya or and Maringanha, a suburb of the city of Pemba in Mozambique) with larger population sizes than other sites and a wider array of livelihood activities. Peri-urban sites such as Mieze along the main road to Pemba in Mozambique which is further inland and agriculture forms the basis of the local economy but mangroves also support crab fishing. Rural sites such as Mkwiro south of Mombasa, Kenya is on Wasini Island and livelihood activities include tourism (predominantly day trippers from Mombasa) and fishing, or the isolated Lalane in

Mozambique, north of Pemba where fisheries are the primary source of livelihood were also studied.

Despite these differences all communities were deriving some benefits from their adjacent coral reef or mangrove ecosystems. These in turn were in different conditions and were managed in different ways. Some sites had no form of conservation or environmental management measures in place (e.g. fisheries in Lalane) whilst others had nearby managed marine national parks (Kongowea and Mkwirow), an NGO and tourism industry-supported community-based marine sanctuary (Vamizi) or mangroves managed through limited licencing by government forest services (Vanga).

***Operationalising a human needs approach.***

The process was developed to combine both expert and community perspectives by enabling public deliberation to evaluate how human needs are met, using locally relevant thresholds. Developing a set of agreed indicators for basic needs, the degree to which they are met within communities and evaluating the contribution of ecosystem services to them was undertaken in five distinct steps (Appendix S1).

***STEP 1 – VERIFYING THE LIST OF NEEDS***

This step introduced the theory-based list of human needs and aims to ascertain the extent to which it reflects community conceptualisations of human needs, capturing any differences or additions.

In each site, men's and women's focus groups were convened. We conducted 16 focus groups in all (two at each site). Participants were purposively sampled based on information gathered via community profiling and key informant interviews to incorporate a range of income groups, ethnic groups, primary occupations, gender and geographical areas of the community. Each focus group was asked "how would you describe a household that is 'doing well' or 'doing badly'?". The emergent list of context relevant wellbeing criteria was then compared with a list of 12 theory derived basic human needs (shelter, economic security, sanitation, drinking water, food security,

health, education, physical security, respect, relationships, autonomy and participation) to ensure they were comparable and avoid missing characteristics of wellbeing important to communities. If new aspects of wellbeing were mentioned that are not captured these can be added to the list in further steps. To ensure consistency within sites and a correspondence with the pre-existing research and theory on needs, if specific needs were not mentioned by participants, these were still included in the subsequent steps.

#### *STEP 2 – ELICITING NEEDS INDICATORS*

Within the same focus groups, indicators were elicited for each need which were more specific than the first step as it focuses on specific characteristics of each need which can enable their measurement. Whilst needs are considered to be universal, the ways in which they are satisfied; i.e. whether people are above or below a level at which the need is met (threshold of harm), may vary in different contexts (Doyal & Gough 1991). For each need therefore, we derived a list of needs indicators by asking participants to describe conditions under which a person is doing well or badly for each need

#### *STEP 3 – IDENTIFYING BASIC NEED THRESHOLDS*

A follow-up focus group at each site was carried out with a subset of people from each focus group to determine site specific thresholds of harm for each need (Appendix S2). The indicators generated in step 2 were grouped together under the different needs and we asked participants to arrange the list for each need from “doing well” to “serious harm”. The participants were then asked to reflect on the ordered list of indicators and, for each need deliberate and decide at which point they consider a person or a household to be in serious harm due to deprivation of that need. This was equivalent to a human needs threshold, above which a need is met and below which a need is unmet.

#### *STEP 4 – CREATING HOUSEHOLD SURVEY QUESTIONS*



We took the indicators from step 3 close to the threshold of harm (e.g. a person sometimes does not eat for a whole day) and converted these into simple questions for inclusion in a large-scale household survey (e.g. “Over the last year, have you ever not eaten for a whole day due to lack of food?”). The survey was then administered to a representative sample of the population at each site and simple data processing rules were used to evaluate whether each basic need was met or not for each respondent. The final thresholds and processing rules were based on a triangulation between the contextual information from focus groups and local and expert views. In few cases, rules also reflected expert judgement where focus group outputs did not fully reflect possible harm (e.g. from polluted water sources).

The household survey was conducted across 1130 randomly selected households. For representation of within household variation (Agarwal 1997), we interviewed up to three people per household where this was possible, including the household head, spouse and a randomly chosen third person aged above 15, resulting in a total of 2293 interviews. To aggregate multiple responses per household to a single household level human needs assessment, we first assessed each basic need per person and then classed a household as meeting a particular need if each person in the household had met the need.

The basic need of participation was assessed in Mozambique but not in Kenya due to different approaches used. In the latter, where respondents were solely asked about their membership of organisations where the question was frequently misinterpreted and could not be readily assessed against a participation threshold.

#### *STEP 5. EXPLORING HOW ECOSYSTEM SERVICES CONTRIBUTE TO NEEDS*

A group discussion was held with a diversity of key informants at each site to elicit the benefits (ecosystem services) they obtain from the environment. A number of different ecosystem services were identified (Appendix S3). The compiled list of services from these discussions fed into a further

two (one male and one female) focus groups at each site. In these focus groups, for each of the basic needs, we asked participants which of the ecosystem services contributed to it in that site, why they did, and how important this effect was (1: little importance to 3: very important). Descriptive quantitative analysis was conducted to elucidate the relative importance of different ecosystem benefits for different needs. We present findings from the five ecosystem-derived benefits that were perceived to be the most important for wellbeing across the eight sites studied.

## Results.

### *Identifying when needs are met*

All wellbeing criteria described by participants in response to questions about who in the community is “doing well” or “doing badly” across sites (step 1) were closely related to different needs identified by the theory of human need (Appendix S4). Certain wellbeing criteria mentioned for those doing well or badly, could form part of one or a number of different human needs. In Mize for example, someone doing very well was described as someone who does agriculture which involves producing goods for food or for business and therefore can contribute to economic or food security (Appendix S5). Conversely, no wellbeing criteria were found to be associated with someone doing well or badly with regards to water availability at any site. In Mozambique, other needs such as physical security, respect, autonomy, participation and relationships were also not linked to any specific needs in certain sites (Appendix S6).

When eliciting indicators of doing well or badly for each need (step 2), focus groups showed substantial variation in their interpretation of what it means to ‘do well’ (Table 1). However, characteristics of ‘doing badly’ for each need were consistent at each site. Indicators clustered around thresholds of harm could be categorised according to one or two broader characteristics. In the case of education for example (Table 1) indicators of “serious harm” were similar across sites including school attendance (in particular due to school/enrolment fees) and scholarly equipment

(such as books and adequate clothing). Lack of adequate scholarly equipment was thought to prevent children from attending school, therefore only questions related to being enrolled at school and school attendance were included in the household questionnaire. Participants in Mize, Mozambique felt that although some in the community were doing badly in terms of education, nobody was in serious harm and therefore no indicators were found to be below the threshold of harm.

Due to the similarities in indicators clustered around thresholds of harm, similar questions in the survey were asked at each site. In the case of education, a household was considered to be in serious harm if children were not enrolled at school or missed school once a week or more.

Such consistency in indicators around thresholds of harm across sites occurred for most human needs, but not all. When considering water for example, combinations of answers that determined serious harm or not differed between sites. Unlike other sites, having access to a well in Lalane did not exempt households from being in serious harm as the water quality in the well was deemed by the field and research team with extensive knowledge of the sites to be very poor due to its shared use with animals and livestock, and proximity to the sea.

### ***Which needs are being met?***

Overall, the level of needs fulfilled was higher in Kenya (mean=78.5%, SD=11.4%) than in Mozambique (mean=61.9%, SD=14.2%). We found strong variation in needs fulfilment between sites within country for some needs such as sanitation and economic security in Kenya and water, autonomy and education in Mozambique (Fig. 2). For several needs, however, we found strong similarities between sites. Nearly all households had their need for shelter, health and autonomy fulfilled (more information about proportion of needs met/unmet at each site for men and women is available at <http://www.espa-spaces.org/resources/spaces-data-explorer/>).

### ***How do ecosystem services contribute to needs?***

The mentioned ecosystem-derived benefits across sites were diverse (Appendix S3). Provisioning services were most frequently cited and considered most important, although regulating services such as provision of shade and cultural services such as tourism were also mentioned. The majority of effects of ecosystem services on wellbeing were positive, but some negative examples (such as collecting of shells having a negative effect on school attendance) were given. Combining the importance ascribed to each good for different human needs from each focus group allowed us to explore how the surrounding environment contributed to different wellbeing domains. The approach taken however biases provisioning and cultural services as it emphasises what people relate to most directly. This is one of its' strength, as it enables us to explore goods and services that experts may tend to overlook that are important for people in different contexts. However, it can also be a weakness as it may not include more "invisible" supporting and regulating services.

Whilst fish and octopus were both perceived very important for different needs across both countries, in Mozambique, a greater importance was attributed to them for certain specific needs, in particular food security, economic security and relationships (Table 2). Kenyan participants perceived ecosystem services to be more important for a wider range of needs. This was particularly so in the case of mangroves poles and firewood where they were perceived as important for a wider set of needs than in Mozambique.

Gender had a strong effect on the perception of ecosystem service benefits and their contribution to needs. Women's focus groups perceived mangrove firewood of particular importance to education, due to its role in cooking and hence food and nutrition security of children, as well as a source of income to be used for buying school uniforms. Men, however, perceived mangrove firewood to be predominantly important for physical security as it can be used for self-defence to protect oneself and ones' families in the event of an intruder.

We also found evidence of trade-offs in the ecosystem service-needs interactions. For example, shell picking was perceived to be important for education at most sites by both men and women, as

income obtained from harvesting and selling shells contributed to school fees, uniforms and equipment. However, it was also perceived to have a negative effect on the education of girls in Mozambique who regularly miss school at low tides to pick shells.

## Discussion

The human needs approach enabled us to characterise the extent and nature of multidimensional poverty using locally-grounded indicators of deprivation to a range of specific needs. Secondly it provided a framework to explore how environmental benefits contribute to people meeting their needs. It can therefore help target development interventions towards needs that are least met at each site (Fig. 2.), to consider how benefits derived from the environment are making significant contributions to meeting these needs currently and to monitor and evaluate conservation plans to ensure they have not pushed people into serious harm.

Decision makers involved in conservation or environmental management could use this approach to consider anticipated impacts on different ecosystem services, and explore repercussions this would have on different needs. Octopus for example, may not be perceived as important for economic security in Kenya and therefore the impacts of conservation interventions such as marine protected areas or gear restrictions that may reduce access to octopus may not be given much weight. Our findings however, suggest that octopus is important for a range of different needs such as health, education and food security, which may result in some households no longer meeting these needs and hence become households in serious harm. This approach may also prove useful when considering the social impacts of large-scale development policies on removing access to ecosystem services such as the current situation with the expansion of the oil and gas industry in Northern Mozambique.

The multidimensional description of deprivation within communities can also challenge perceptions and open up new avenues for resource management or poverty alleviation. Fishing households, for

example, had higher likelihood of meeting income security and education needs but often had lower or no greater chance of meeting other needs such as shelter, sanitation and food security. This indicates that the higher incomes of fishing households may not translate into relief of multidimensional poverty and may open up avenues to navigate trade-offs between fishing.

Our analysis also highlights how actively participating in meetings and interaction with others in a community is deemed important for human needs of respect and relationships and is linked to the threshold of harm for autonomy. This highlighted a window of opportunity for Vamizi, where there is a community based marine protected area. Ensuring a broader participation in fisheries meetings decision making around the MPA could improve the number of people meeting these basic needs.

One of the merits and difficulties of this approach is the tension that exists between expert and local views on when a need is met or unmet. The demise of “needs” thinking in the 1980s can be attributed to the paternalistic attitude surrounding the approach. It was deemed arrogant to lay down what people should regard as a human needs or not (Streeten 1984). The participatory and inclusive process of deriving thresholds in this study helps to address that critique, with indicators for each need being created during focus groups. However, when deciding on when a need was met or not, some in-country expert opinions were required. The focus group participants may have adapted to poor conditions and accept conditions that are seriously harmful as simply “part of life”. This reflects Sen’s (2001) concern with ‘adaptive preferences’ in which people internalise the harshness of their circumstances so that they do not desire what they can never expect to achieve (see also Clark 2012). In Lalane (rural Mozambique) for example, the majority of households only have access to two wells with poor water quality, however access to safe drinking water was not identified by the focus groups as an issue for the community. This demonstrates the need for an expert view to make sure that the threshold of harm is not set too low by local participants. Future work in these communities, however, could be carried out with the same questionnaire questions removing the need to replicate steps 1-4 for a more rapid needs assessment. The thresholds of harm

questions can be asked as part of the questionnaires that are planned or on-going at little extra time or monetary cost.

Whilst the list of basic human needs do not vary and are universal, the ways in which these are met are context specific and may potentially vary over time. New technological advances or development projects for example, may provide different means to meeting a basic need. Other changes in a socio-ecological context such as new environmental pressures or changes in the demography may also affect how needs are met or unmet, complicating the relationship between conservation actions and basic needs. For example conservation which limits access to a resource, may not impact peoples need if this coincides with new accessible and acceptable (or even favourable) ways of meeting that need. Alternatively, basic needs may become unmet in the course of, but not due to, conservation action as a result of concomitant social or ecological changes. The approach presented here assesses multidimensional deprivation but does not attempt to attribute deprivation to particular causes such as conservation interventions. However, conservationists could adopt or supplement the method in order to monitor the effects of specific actions.

General improvements in welfare may also lead to re-evaluations as to what constitutes meeting a basic need thus shifting thresholds of harm over time. Despite the potential for thresholds to be context and time specific, our data showed a surprising consistency of thresholds across a range of urban to rural sites in two countries, suggesting that thresholds of harm in meeting the most basic needs are relatively consistent across different contexts – even if aspirations may be different in different sites. This supports the use of thresholds as an indicator of deprivation, but they should not be uncritically used over long or transformative periods of time. It may be prudent to repeat focus groups to check that thresholds remain appropriate.. An avenue for future work would be to carry out longitudinal studies to see how these thresholds of harm shift in different contexts and what factors may predict this movement.

Another opportunity to further align poverty reduction and environmental sustainability would be to question solely those below or around the threshold of harm. By understanding how those in serious harm engage with ecosystem services and how these services contribute to their different needs, we can get a more accurate picture of the ecosystem services critical for those most in need rather than for the whole community.

Furthermore, whilst the needs approach allows a holistic evaluation of multiple dimensions of deprivation, it does not solely consider conservation interventions and their impacts on wellbeing. Whether or not harm as a result of missing basic needs is caused or alleviated directly by conservation efforts, people being deprived of their basic needs imposes instrumental and moral constraints and responsibilities on conservation organisations. Future work could pay more attention to how people feel about conservation governance, which has been shown by Dawson et al (2017) to vary independently of more objective measures of wellbeing. Thus this approach could be complimented by an environmental justice approach that more explicitly addresses people's experiences of different dimensions of environmental justice.

The needs approach put forward in this study identifies a context specific minimum threshold of human welfare below which a person would incur serious harm of an objective kind. Policies to conserve resources, if poorly designed, can push people into serious harm and vice versa. Currently, whilst 'do no harm' conservation sounds like a good principle and ethic to follow, practitioners have little idea on what that means in practice. Using a list of needs helps to break down the concept of harm by clearly defining it. This approach also elucidates the link between different needs and ecosystem services. Combining these two aspects together allows decision makers to ascertain which are the critical ecosystem services for human needs in different contexts. It can also help in monitoring and evaluating the impact of conservation plans so as to ensure that these do not increase the number of people deprived of basic needs. The approach therefore seeks to balance out and integrate the frequently competing interests of conservation and development in social-



ecological systems. As such, it can inform the search for policy or interventions that lead to positive environmental changes that at the very least, don't push people in serious harm.

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## Supporting Information

The distinct steps followed to assess the level of basic needs (Appendix S1), a focus group guide which explains how to derive the thresholds of harm (Appendix S2), the different ecosystem services identified and their relative contributions to basic needs (Appendix S3), the summary data which identifies all wellbeing criteria and their associated needs across all sites (Appendix S4), the example of culturally relevant wellbeing criteria described by participants in Mize, Mozambique (Appendix S5) and the frequency of wellbeing criteria being discussed at each site (Appendix S6) are available online. The authors are solely responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author.

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## Tables

**Table 1.** Thresholds of serious harm (in bold lines) identified for the basic need of education by participants at each site in Kenya and Mozambique below which indicates a need is not met.

Mozambique				Kenya			
Vamizi	Lalane	Maringanha	Mieze	Mkwiro	Vanga	Kongowea	Tsunza
Studies at high school		Children go to university					
Has uniform		Parents take their children to school by car					
Has school bag		Children take lunch and money to school	Children attend high school			International education system	Education up to university/college
Takes lunch to school	Well behaved	Children have a cell phone	Has all necessary school equipment			Expensive /special schools Private schools/academy	Extra tuition
Finish 5th level (primary)	Keep good care of their books	Children finish secondary school	Children go to school		United family	Education to university guaranteed	Extra teachers employed privately
Has exercise book	Parents do school enrolment	Parents take their children to school by motorbike	Don't finish the school level	Ability to pay fees	Good health	Fully paid fees	Children in academy
Has shoes for school	Children give up school	Has shoes	The father does not worry about child education	Children in private schools /academy	Savings upheld	Private tuition	Guaranteed employment
Uses hands to write on	Children don't have lunch	Has school bag	The children rarely go to school	Easy to attend college/university	Children in private schools/academy	Slight quality education	Children in public schools
Does not have uniform	Children don't have uniform	Study until 7th level (primary)	Children don't have necessary school equipment or lunch	Extra tuition	Fees fully paid	School tuition	Children are very bright
		Uses hands to write on		Children only attend some years due to school fees	Full uniforms and stationery	Seasonal financing of children education	Have at least one pair of uniform
		Does not have uniform		Reliance to sponsorship/donor	No savings	Few teachers and class with many students	Moderate fee payment
				Children attend government schools	No tuition	No transport to school	Persistent problems in schools fees at secondary level
					Fees not paid	No equipment	No pocket money
					Children at home most time instead of being in schools	Free education	Children drop out at end of primary level
					Continued conflicts		No sufficient stationery
<b>Threshold of harm</b>							
Does not finish primary school	Parents don't enrol kids to school	Parents don't enrol kids to school		Cannot afford school fees	Low education interest parents and children	Children drop out at end of primary level	Lack of morale for school children
				Lack of food makes children weak to attend school	drop out of school due to early marriages	No vision in education	Cannot afford fees
						Irregular	Children have no

				Children drop out of school		attendance to school	time to study (need to support parents in other duties)
				No family planning		No tuition	
						Cannot afford fees	
						No uniforms	

**Table. 2.** Combined men's and women's focus groups' perceived importance of goods (as a percentage of maximum importance that could be attributed) derived from the environment across Kenyan and Mozambican sites

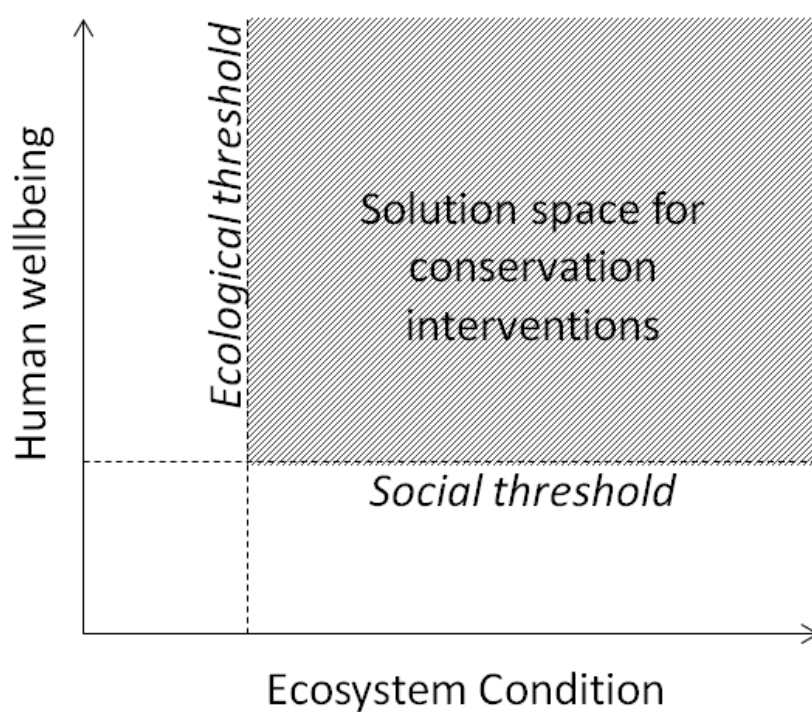
Ecosystem Derived Goods		Health	Education	Physical Security	Water	Respect	Autonomy	Shelter	Food	Economic Security	Participation	Sanitation	Relationships
Kenya	Fish	79	96	58	67	63	92	88	83	88	54	50	88
	Octopus	50	58	33	38	38	29	46	54	33	21	33	42
	Mangrove Poles	46	79	63	25	29	33	83	63	67	25	54	50
	Mangrove Firewood	33	58	33	17	13	75	29	83	71	38	13	58
	Shells	8	25	0	21	13	17	21	8	29	13	21	46
Mozambique	Fish	50	96	21	0	75	71	79	96	96	63	75	96
	Octopus	46	75	13	0	54	42	46	79	79	50	50	58
	Mangrove Poles	0	29	54	0	21	33	79	4	42	25	58	33
	Mangrove Firewood	4	8	25	0	0	8	0	17	17	4	17	4
	Shells	0	54	0	0	29	38	29	67	46	25	33	29

## Figure Legends

Figure 1. Using ecological and social thresholds to define a solution space for conservation

Figure 2. Percentage of households per site above the threshold of serious harm for each need in Kenya (darker grey) and Mozambique (lighter grey).

Figure 1. Using ecological and social thresholds to define a solution space for conservation



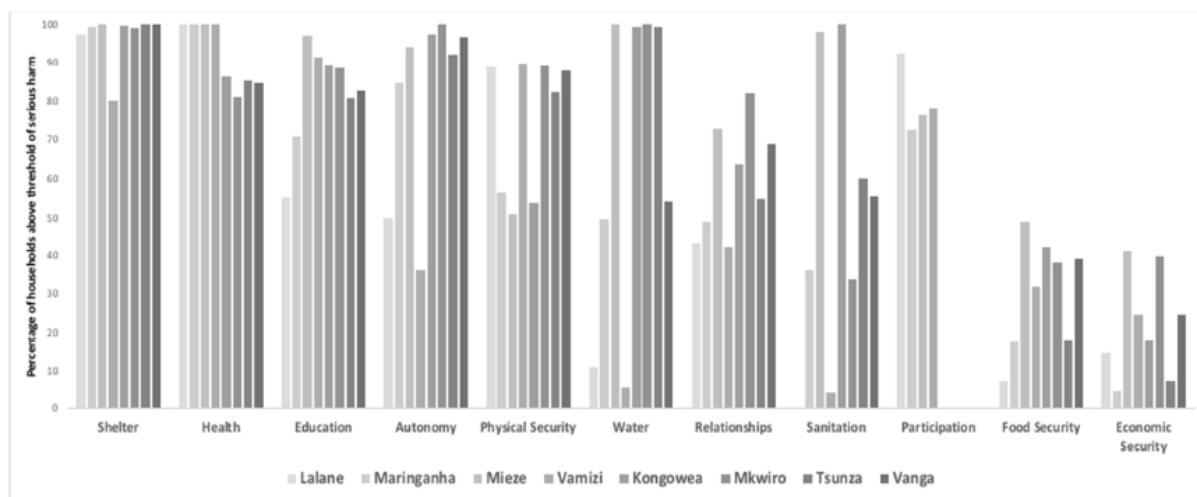


Figure 2. Percentage of households per site above threshold of serious harm for each need in Kenya (darker grey) and Mozambique (lighter grey).